

Claims:

1. A digital spirit level comprising a housing with a leveling surface for placing on a surface, an inclination measurement module for measuring an inclination measurement of a surface, and a display driver for displaying inclination measurements of vertical surfaces upright relative to 0° horizontal for facing a user holding the digital spirit level against a vertical surface for facilitating straight on reading of its inclination measurement.
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- 10 2. The level according to Claim 1 wherein said display driver displays inclination measurements of vertical surfaces relative to 0° vertical instead of 0° horizontal for upright display relative to 0° horizontal.
- 15 3. The level according to either one of Claims 1 and 2 wherein said display driver drives a display screen including a pair of orthogonal seven segment arrays for displaying inclination measurements of surfaces where a first seven segment array of said pair of orthogonal seven segment arrays displays inclination measurements of surfaces perpendicular to said leveling surface and a second seven segment array of said pair of orthogonal seven segment arrays displays
20 inclination measurements of surfaces parallel to said leveling surface.
- 25 4. The level according to Claim 3 and further comprising an attitude detection module for detecting the attitude of the digital spirit level relative to 0° horizontal for providing an input signal for determining whether to display an inclination measurement of a surface whose inclination is close to a changeover inclination on either said first seven segment array or said second seven segment array.
- 30 5. The level according to either one of Claims 1 and 2 wherein said display driver drives a graphic display screen for displaying inclination measurements

upright relative to 0° horizontal irrespective of the attitude of said leveling surface thereto.

6. The level according to any one of Claims 1 to 5 wherein said inclination measurement module determines inclination measurements of surfaces as a function of the capacitances of a pair of variable capacitors having capacitances proportional to an inclination of a surface and inversely affected by a change in its inclination relative to 0° horizontal.
- 10 7. The level according to Claim 6 wherein at least one capacitor of said pair of variable capacitors has a maximum capacitance and a minimum capacitance on placement of said housing at 90° and 270° relative to 0° horizontal.
- 15 8. The level according to either one of Claims 6 and 7 wherein at least one capacitor of said pair of variable capacitors has a pair of parallel metal plates and is partially filled with a dielectric liquid for changing its capacitance as a function of the inclination of a surface relative to 0° horizontal.
- 20 9. The level according to Claim 8 wherein at least one capacitor of said pair of variable capacitors has an annular shaped metal plate having a radial width continuously increasing from a minimum width to a maximum width over a full 360°.
- 25 10. The level according to any one of Claims 6 to 9 wherein said pair of variable capacitors are discrete electrical components.
11. The level according to any one of Claims 6 to 9 wherein said pair of variable capacitors have a common metal plate.

12. The level according to any one of Claims 6 to 11 wherein said pair of variable capacitors are staggered lengthwise along said housing.

13. The level according to any one of Claims 6 to 11 wherein said pair of 5 variable capacitors are deployed side by side widthwise in said housing.

14. The level according to any one of Claims 1 to 4 wherein said inclination measurement module determines an inclination measurement of a surface as a function of an electric field for maintaining a meniscus of a dielectric liquid at a 10 pre-determined reference position.

15. The level according to Claim 14 wherein said inclination measurement module includes a meniscus position detector for optically detecting an instantaneous position of said meniscus relative to said reference position, an 15 electric field generator for generating said electrical field for controlling the position of said meniscus relative to said reference position, and an inclination compensation circuitry for controlling said electric field generator for maintaining said meniscus at said reference position.

20 16. The level according to either one of Claims 14 and 15 wherein said electric field generator maintains a meniscus in a bubble vial at a pre-determined reference position.

25 17. The level according to either one of Claims 14 and 15 wherein said electric field generator maintains a meniscus in a dielectric liquid filled toroid at a pre-determined reference position.

30 18. A digital spirit level comprising a housing with a leveling surface for placing on a surface, an inclination measurement module for determining inclination measurements of surfaces as a function of the capacitances of a pair of

variable capacitors having capacitances proportional to an inclination of a surface and inversely affected by a change in its inclination relative to 0° horizontal, and a display driver for displaying said inclination measurements.

- 5 19. The level according to Claim 18 wherein at least one capacitor of said pair of variable capacitors has a maximum capacitance and a minimum capacitance on placement of said housing at 90° and 270° relative to 0° horizontal.
- 10 20. The level according to either one of Claims 18 and 19 wherein at least one capacitor of said pair of variable capacitors has a pair of parallel metal plates and is partially filled with a dielectric liquid for changing its capacitance as a function of the inclination of a surface relative to 0° horizontal.
- 15 21. The level according to Claim 20 wherein at least one capacitor of said pair of variable capacitors has an annular shaped metal plate having a radial width continuously increasing from a minimum width to a maximum width over a full 360°.
- 20 22. The level according to any one of Claims 18 to 21 wherein said pair of variable capacitors are discrete electrical components.
- 25 23. The level according to any one of Claims 18 to 21 wherein said pair of variable capacitors have a common metal plate.
24. The level according to any one of Claims 18 to 23 wherein said pair of variable capacitors are staggered lengthwise along said housing.
- 30 25. The level according to any one of Claims 18 to 23 wherein said pair of variable capacitors are deployed side by side widthwise in said housing.

26. The level according to any one of Claims 18 to 25 wherein said display driver displays inclination measurements of vertical surfaces upright relative to 0° horizontal for facing a user holding the digital spirit level against a vertical surface for facilitating straight on reading of its inclination measurement.

27. The level according to Claim 26 wherein said display driver displays inclination measurements of vertical surfaces relative to 0° vertical instead of 0° horizontal for upright display relative to 0° horizontal.

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28. The level according to either one of Claims 26 and 27 wherein said display driver drives a display screen including a pair of orthogonal seven segment arrays for displaying inclination measurements of surfaces where a first seven segment array of said pair of orthogonal seven segment arrays displays inclination measurements of surfaces perpendicular to said leveling surface and a second seven segment array of said pair of orthogonal seven segment arrays displays inclination measurements of surfaces parallel to said leveling surface.

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29. The level according to Claim 28 and further comprising an attitude detection module for detecting the attitude of the digital spirit level relative to 0° horizontal for providing an input signal for determining whether to display an inclination measurement of a surface on either said first seven segment array or said second seven segment array whose inclination is close to a changeover inclination.

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30. The level according to either one of Claims 26 and 27 wherein said display driver drives a graphic display screen for displaying inclination measurements upright relative to 0° horizontal irrespective of the attitude of said leveling surface thereto.

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31. A digital spirit level comprising a housing including a leveling surface for placing on a surface, an inclination measurement module for determining inclination measurements of surfaces as a function of an electric field for maintaining a meniscus of a dielectric liquid at a pre-determined reference 5 position, and a display driver for displaying said inclination measurements.

32. The level according to Claim 31 wherein said inclination measurement module includes a meniscus position detector for optically detecting an instantaneous position of said meniscus relative to said reference position, an 10 electric field generator for generating said electrical field for controlling the position of said meniscus relative to said reference position, and an inclination compensation circuitry for controlling said electric field generator for maintaining said meniscus at said reference position.

15 33. The level according to either one of Claims 31 and 32 wherein said electric field generator maintains a meniscus in a bubble vial at a pre-determined reference position.

20 34. The level according to either one of Claims 31 and 32 wherein said electric field generator maintains a meniscus in a dielectric liquid filled toroid at a pre-determined reference position.

25 35. The level according to any one of Claims 31 to 34 wherein display driver displays inclination measurements of vertical surfaces upright relative to 0° horizontal for facing a user holding the digital spirit level against a vertical surface for facilitating straight on reading of its inclination measurement.

30 36. The level according to Claim 35 wherein said inclination measurement module measures inclination measurements of vertical surfaces relative to 0° vertical instead of 0° horizontal for upright display relative to 0° horizontal.

37. The level according to either one of Claims 35 and 36 wherein said display driver drives a display screen including a pair of orthogonal seven segment arrays for displaying inclination measurements of surfaces where a first seven segment

5 array of said pair of orthogonal seven segment arrays displays inclination measurements of surfaces perpendicular to said leveling surface and a second seven segment array of said pair of orthogonal seven segment arrays displays inclination measurements of surfaces parallel to said leveling surface.

10 38. The level according to Claim 37 and further comprising an attitude detection module for detecting the attitude of the digital spirit level relative to 0° horizontal for providing an input signal for determining whether to display an inclination measurement of a surface on either said first seven segment array or said second seven segment array whose inclination is close to a changeover
15 inclination.

39. The level according to either one of Claims 35 and 36 wherein said display driver drives a graphic display screen for displaying inclination measurements upright relative to 0° horizontal irrespective of the attitude of said leveling
20 surface thereto.